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Metals Load Reduction in Storm Water using High-Efficiency Sweepers

Joint Services Environmental Management Conference
5–9 May 2008, Denver, Colorado

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ADMINISTRATIVE INFORMATION

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SB

Metals Load Reduction in Storm Water using High Efficiency Sweepers

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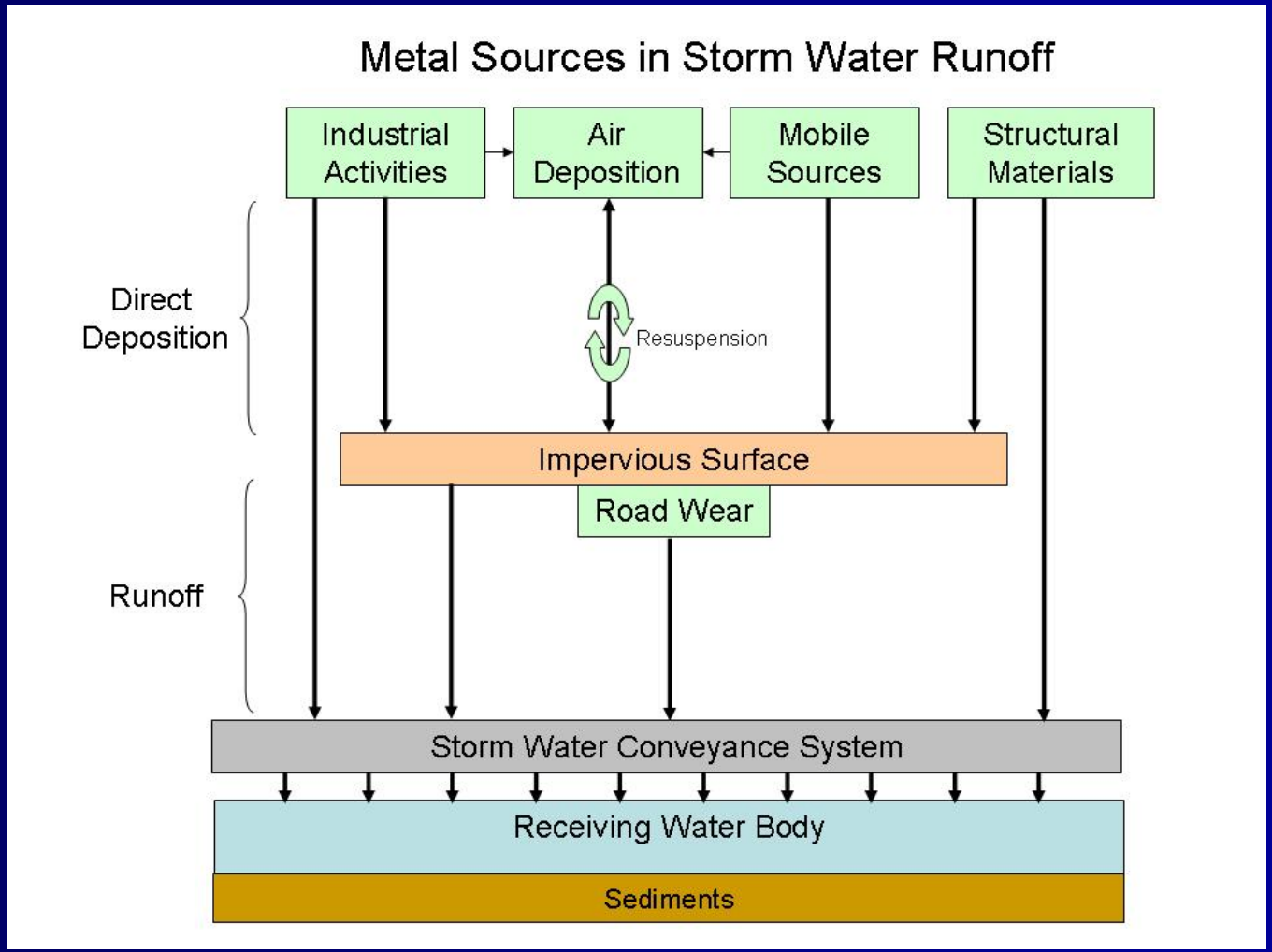
The Problem

- Storm water metal concentrations, particularly copper and zinc, commonly exceed storm or process water discharge compliance requirements resulting in:
  - Lawsuits: Storm water in Navy Region Southwest
  - NOVs: Dry docks in Navy Region Northwest and Hawaii
  - TMDLs: Water and sediment TMDLS in most Regions

Why?

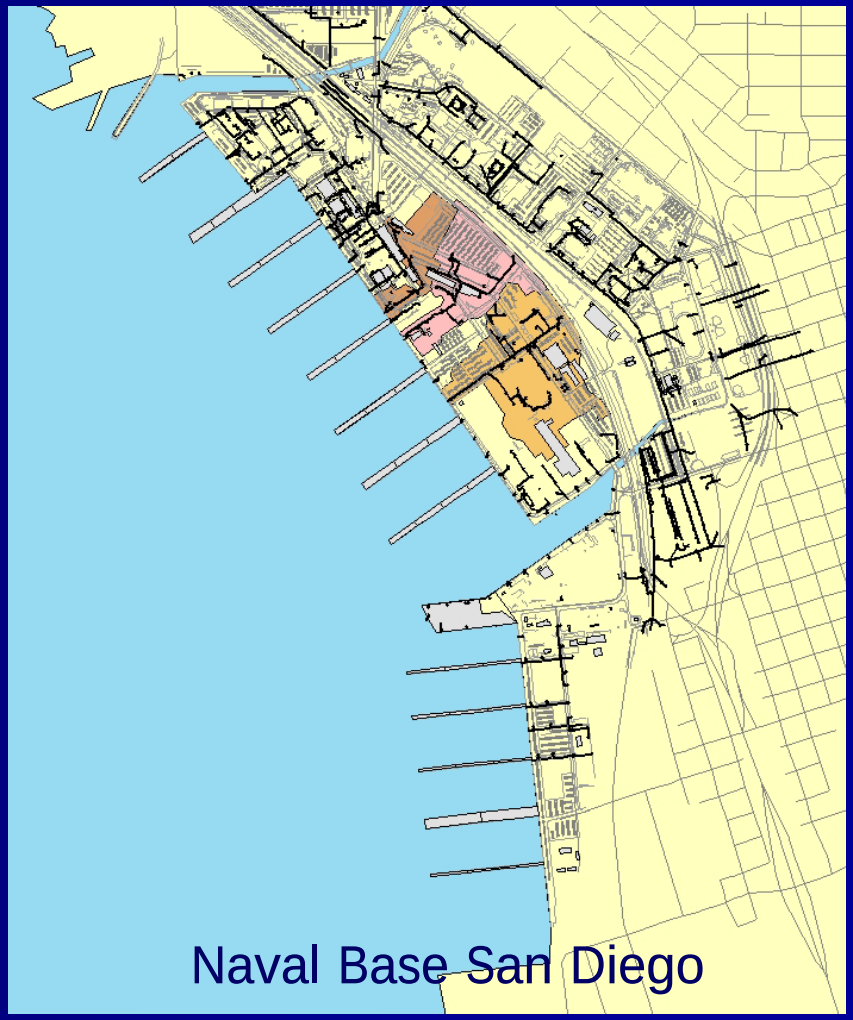
- Numerous widespread sources
- Some sources not easily controlled
- Large areas with many discharge points
- Receiving water impacts occur at low (ppb) concentrations
- Metals accumulate in sediments

Sources and Pathways



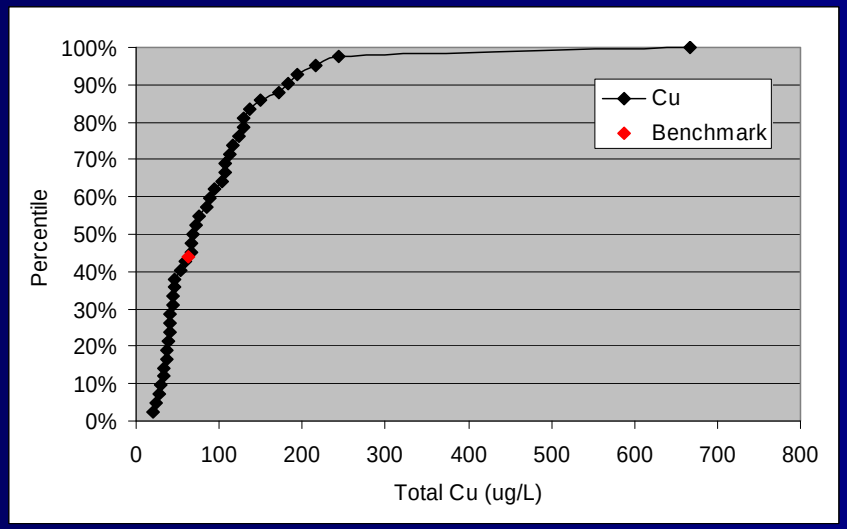
Spatial Extent

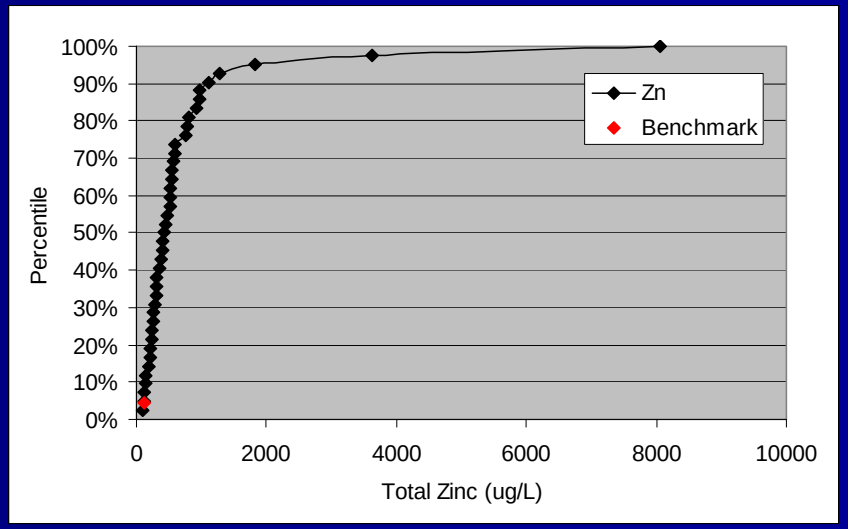
- Storm water:
  - Runs off of thousands of facility acres
  - Is carried through miles of pipes
  - Discharges through hundreds of monitored outfalls



Storm Water Metals

- Copper and zinc routinely exceed benchmarks



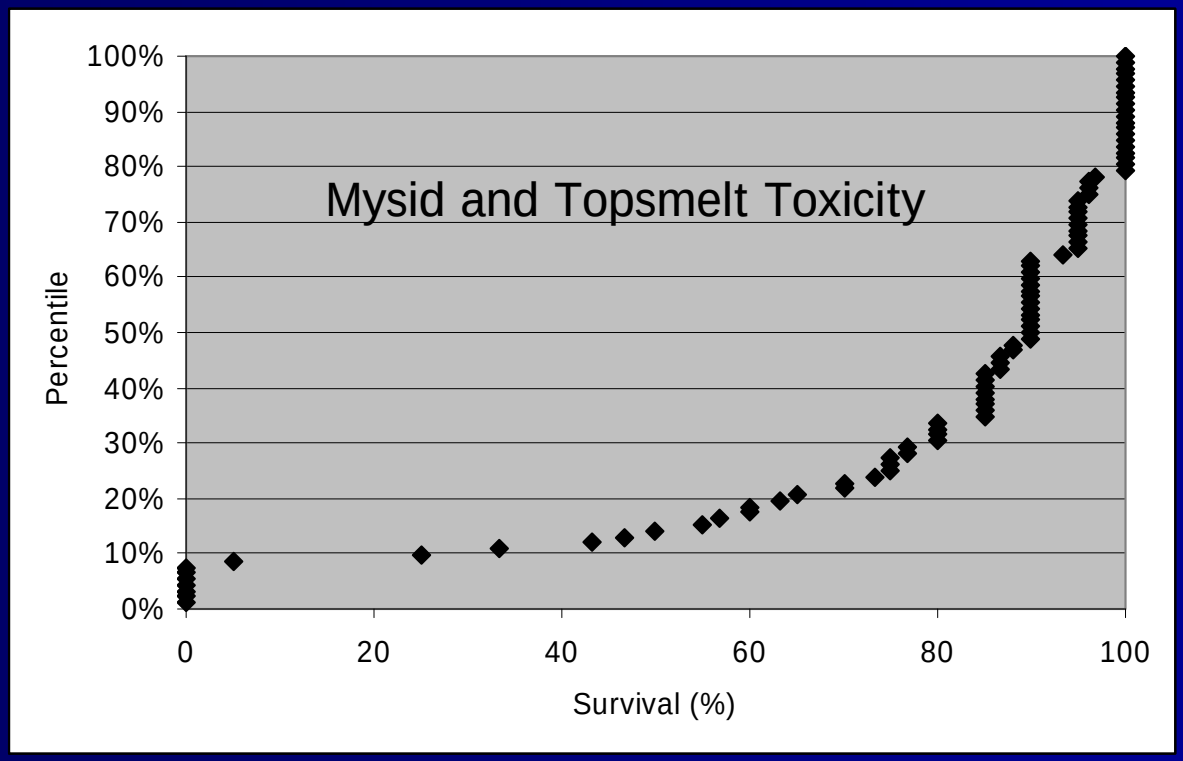


Region Southwest Facility Data*

* Source: Katz, Rosen and Arias (2006). Storm Water Toxicity Evaluation Conducted at Naval Station San Diego, Naval Submarine Base San Diego, Naval Amphibious Base Coronado, and Naval Air Station North Island. Technical Report 1938.

Storm Water Toxicity

- Storm water fails acute toxicity requirements primarily as a result of high copper and zinc



Region Southwest facility data*

Total Maximum Daily Load

- The Navy's TMDL prioritization report identifies over 50 impairments to water, sediment, or tissue as a result of metals*

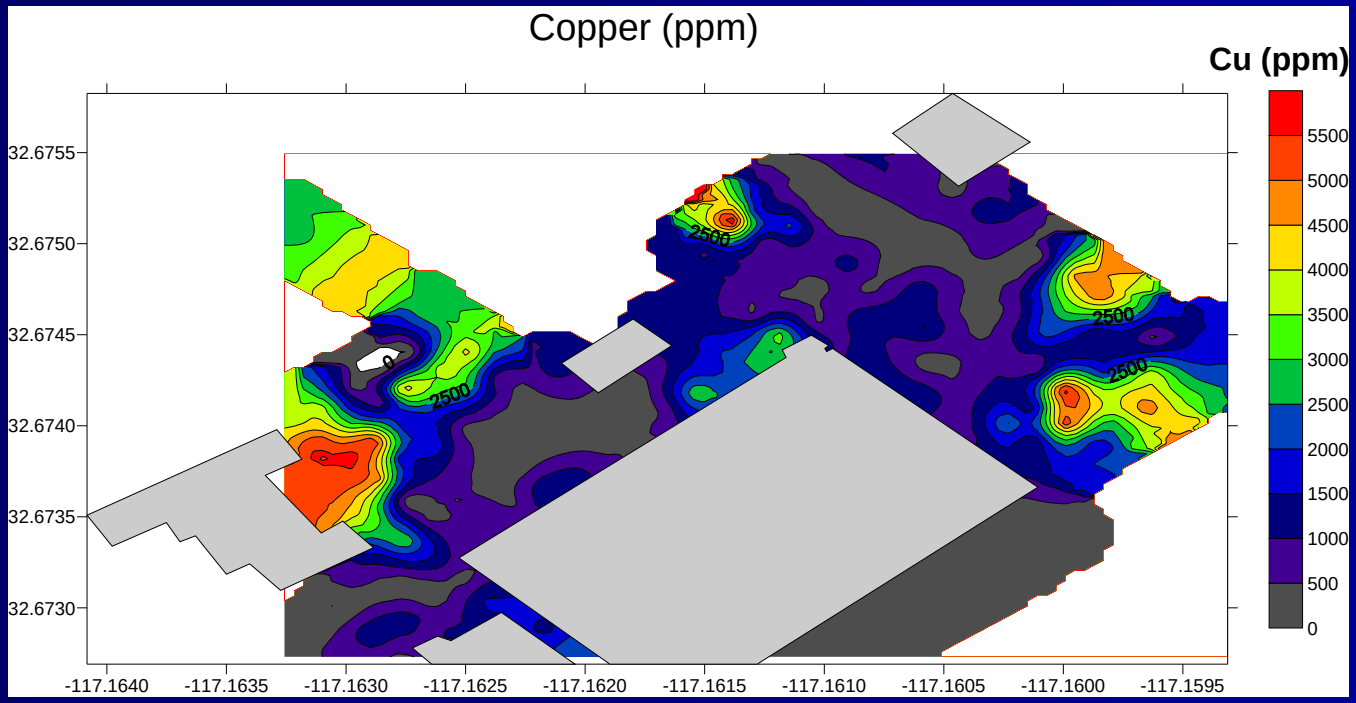
* Source: Navy Total Maximum Daily Load (TMDL) Prioritization Report, September 2006, Naval Facilities Engineering Command.

Why Sweeping BMP?

- Sweeping can be applied to large areas
- Particles on the ground are a source of storm water copper and zinc
- New sweeper technologies may be capable of removing significant amounts of particles and therefore metals

Particles as Metal Source

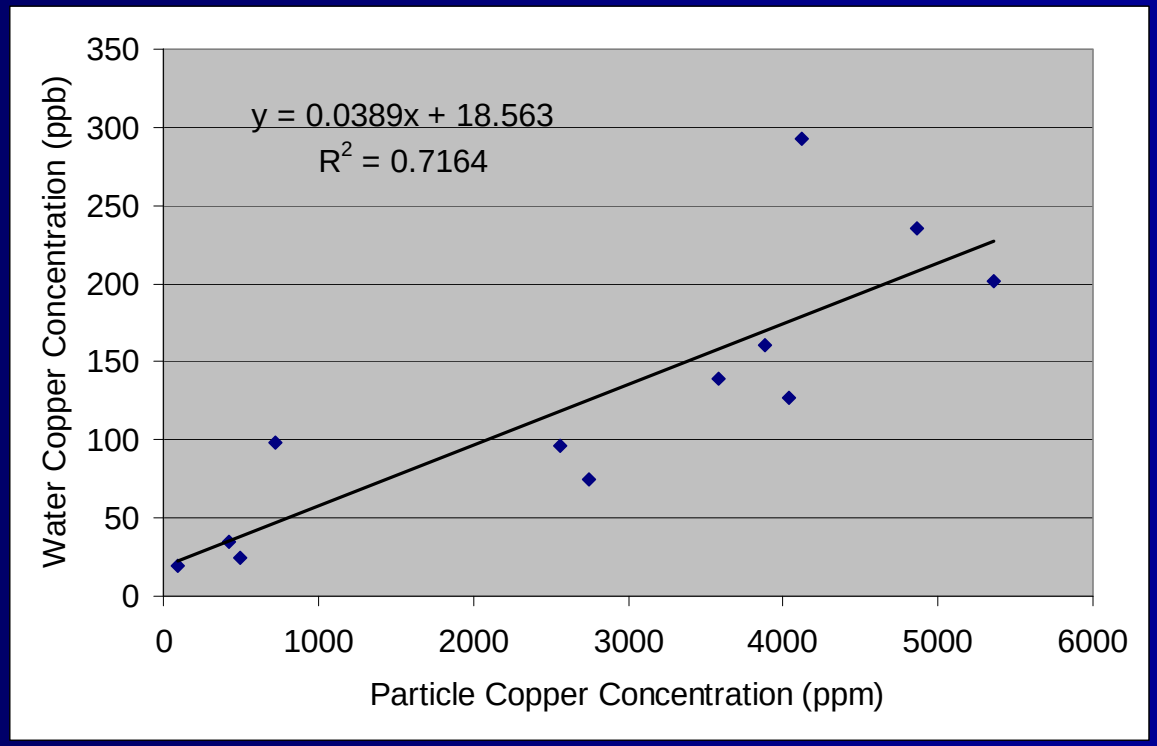
- Early tests showed that particles swept off the ground can be relatively high in copper and zinc



Naval Amphibious Base Coronado

Particles as Source of Dissolved Metals

- Early tests showed particles are a source of dissolved metals



Water concentrations after 30-min contact with water

Sweeper Technology

- Old technology focused on mechanical brushes for large-particle cleaning
- New technology utilizes vacuums, high pressure air or water, tandem systems, and particle filtration to collect fine particles (10 um).

Mechanical

Regenerative Air

Sweeper Technology

Mobile Cleaning, Recovery and Recycling System (MCCRS)

High pressure spray, vacuum, filtration, and water recycling

Proof of Concept

- Develop Sampling Protocols
- Test Quick Screening Techniques
- Evaluate Load Reduction
- Evaluate Sweeper Efficiency

Pier Sweeping - SSC-SD

- Random sites tested for particle metal concentrations
- High efficiency vacuum system evaluated
- Pre/post sweeping evaluated for reductions

● Samples

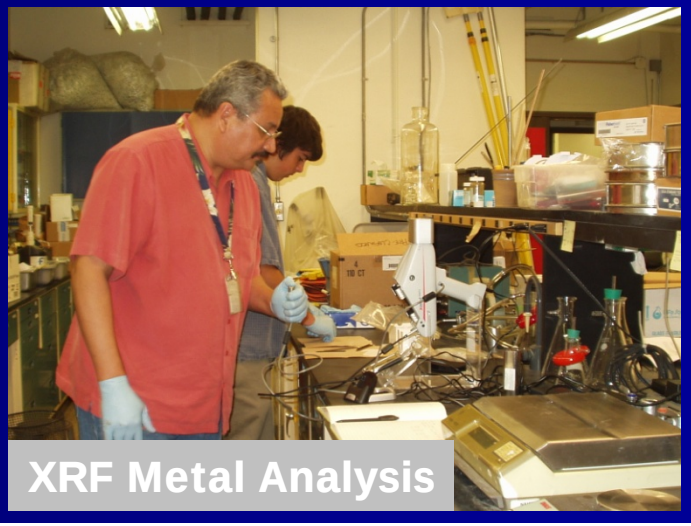
Pier 160 SPAWAR Systems Center San Diego ~ 0.8 acres

Method Development

Collection

Fractionation

Mass Determination



XRF Metal Analysis

Sweeping Operations

Results

- Copper and zinc particle concentrations averaged 700 and 2200 ppm, respectively
- Most particles, copper, and zinc were found in the 0.1 and 1 mm size range
- 52 kg of particles collected (~15 g/m^2)
- Sweeper efficiency ranged between 56 and 71%

MCCRS Test Results

NAB Little Creek

Bridge Caisson Maintenance Area

Copper @ 650 ppm
Zinc @ 80,700 ppm
94-95% Particle Reduction
50-77% Copper Reduction
89-90% Zinc Reduction

Metal Recycling Yard

Copper @ 680 ppm
Zinc @ 4300 ppm
82-84% Particle Reduction
75-90% Copper Reduction
67-71% Zinc Reduction

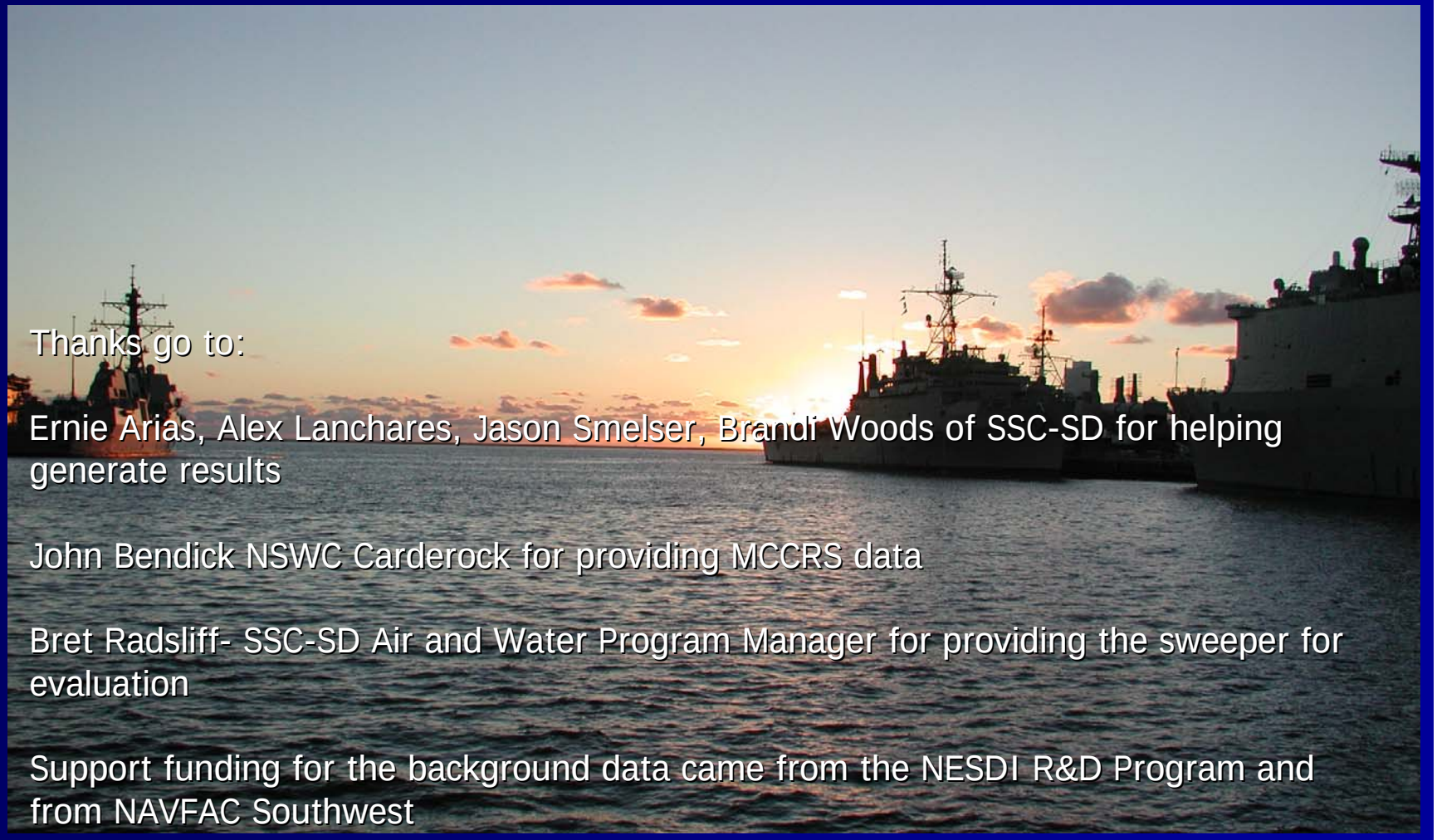
Conclusions

- Particles are a significant source of storm water copper and zinc
- High efficiency sweepers can remove a significant amount of metals before they become entrained in storm water
- Sweeping provides a potentially useful wide-area BMP

Way Forward

- Load reduction quantitation
- Storm water impact validation
- Implementation optimization

Acknowledgments



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14. ABSTRACT

This presentation discusses the problem of storm water metal concentrations, particularly copper and zinc, and based on test results, concludes that new sweeping technology provides potentially useful wide-area best management practices.

15. SUBJECT TERMS

Mission Area: Environmental Science
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